폭연방지기 스프링의 구조해석에 관한 연구

팜민억* · 김부기** · 김준호** · 최민선*** · 양창조***†

* 목포해양대학교 대학원, ** 목포해양대학교 해양메카트로닉스학부, *** 목포해양대학교 기관시스템공학부

A study of Flame Arrestor's Spring Structural Analysis

Minh-Ngoc Pham* · Bu-Gi Kim** · Jun-Ho Kim** · Min-Seon Choi*** · Chang-Jo Yang***†

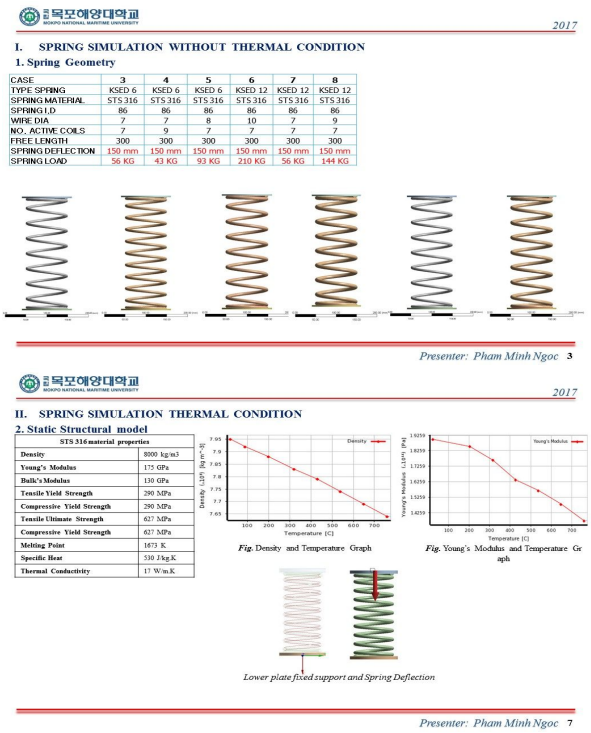
* Graduate School of Mokpo National Maritime University, Mokpo, 58628, Korea

**, Division of Marine Mechatronics, Mokpo National Maritime University, Mokpo, 58628, Korea

,* Division of Marine Engineering System, Mokpo National Maritime University, Mokpo, 58628, Korea

Abstract : *Flame arrestor as end of line flame arrester for endurance burning prevents a light-back at deflagration and stabilized burning (during and after endurance burning) of potentially explosive vapor-air and gas-air mixtures at the end of vent pipes. In a flame arrestor, spring is an important part. The spring load as well as the spring's elasticity determine when the hood is opened. In addition, the spring have to work in high temperature condition due to gas burning. Therefore, it is necessary to analyze mechanical load and elasticity of spring when gas is burned. Based on the dynamic calculation on working process of a specific flame arrestor, analysis of spring is taken. A three dimensional model for spring burned in flame arrestor by using CFD simulation. Results of the CFD analysis are input in FEM simulation to analyze structure of the spring. The simulation results can predict and estimate the spring's load and elasticity at variation of the spring's deflection. Moreover, the obtained result can provide makers with references to optimize design of spring as well as flame arrestor.*

Key Words : *Flame arrestor, Structural analysis, CFD, FEM, springs*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I. SPRING SIMULATION WITHOUT THERMAL CONDITION

1. Spring Geometry

CASE	3	4	5	6	7	8
TYPE SPRING	KSED 6	KSED 6	KSED 6	KSED 12	KSED 12	KSED 12
SPRING MATERIAL	STS 316	STS 316	STS 316	STS 316	STS 316	STS 316
SPRING I.D	86	86	86	86	86	86
WIRE DIA.	7	7	8	10	7	9
NO. ACTIVE COILS	7	9	7	7	7	7
FREE LENGTH	300	300	300	300	300	300
SPRING DEFLECTION	150 mm	150 mm	150 mm	150 mm	150 mm	150 mm
SPRING LOAD	56 KG	43 KG	93 KG	210 KG	56 KG	144 KG

Presenter: Pham Minh Ngoc 3

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II. SPRING SIMULATION THERMAL CONDITION

2. Static Structural model

STS 316 material properties	
Density	8000 kg/m3
Young's Modulus	175 GPa
Bulk's Modulus	130 GPa
Tensile Yield Strength	290 MPa
Compressive Yield Strength	290 MPa
Tensile Ultimate Strength	627 MPa
Compressive Yield Strength	627 MPa
Melting Point	1673 K
Specific Heat	530 J/kg.K
Thermal Conductivity	17 W/m.K

Fig. Density and Temperature Graph

Fig. Young's Modulus and Temperature Graph

Lower plate fixed support and Spring Deflection

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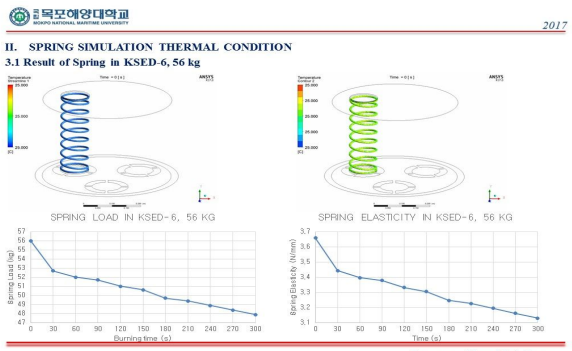
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II. SPRING SIMULATION THERMAL CONDITION

3.1 Result of Spring in KSED-6, 56 kg

SPRING LOAD IN KSED-6, 56 KG

SPRING ELASTICITY IN KSED-6, 56 KG

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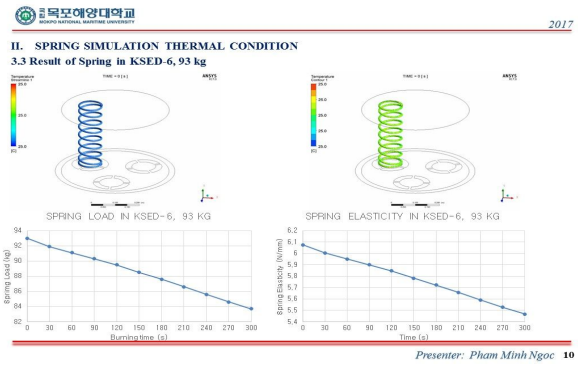
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II. SPRING SIMULATION THERMAL CONDITION

3.3 Result of Spring in KSED-6, 93 kg

SPRING LOAD IN KSED-6, 93 KG

SPRING ELASTICITY IN KSED-6, 93 KG

Presenter: Pham Minh Ngoc 10

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* First Author : pmn5d16@gmail.com, 061-240-7472

† Corresponding Author : cjyang@mmu.ac.kr, 061-240-7228